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(30)Priority

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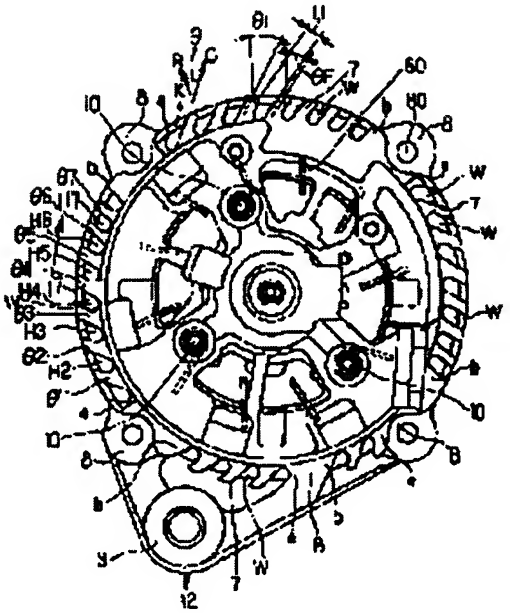
(54) ELECTRIC ROTATING MACHINE

(57)Abstract:

PURPOSE: To increase the flow rate of cooling air while suppressing the noise without increasing the required power by setting the inclination angle of guide wall part determining the direction of cooling air at a high value in the vicinity of the forward end in the rotational direction of a support part and at a low value in the vicinity of the read end thereof.



CONSTITUTION: Cooling air flows from a centrifugal fan 60 into cooling windows W. Each cooling window W is partitioned by a support part 8 and a guide wall part 7 in the peripheral direction. The angle θ between the chord direction G and the radial direction R of the guide wall part 7 is set to increase toward the front end (a) of the support part 8 in the rotational direction and to decrease toward the rear end (b) thereof. Consequently, the cooling air is blown out while inclining slightly in the radial direction in the vicinity of the rear end (b). The air striking the support part 8 is bent forward in the peripheral direction thus increasing the peripheral speed component.

This structure decreases the hydraulic resistance at each guide wall part 7, enhances the straightening effect and increases the flow rate of the cooling air.

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[Date of registration]	13.06.1997
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[Date of extinction of right]	

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] Housing with which opening of two or more cooling apertures was carried out to the peripheral wall together with the single tier to the hoop direction, The stator fixed in said housing, and the rotator held free [rotation in said housing], It has the centrifugal fan which is located inside said cooling aperture and fixed to the edge of said rotator. The peripheral wall of said housing The guidance wall which specifies the cooling direction wind which blows off from said cooling aperture while being located between said two cooling apertures which adjoin a hoop direction and extending to shaft orientations, In a dynamo-electric machine equipped with the support section formed in a hoop direction rather than said guidance wall at double width while being located between said two cooling apertures which adjoin a hoop direction and extending to shaft orientations The tilt angle of said guidance wall to the direction of a path is a dynamo-electric machine characterized by being greatly set up near the hand-of-cut front end of said support section, and being small set up near the method Kogo edge of rotation of said support section.
[Claim 2] The tilt angle of said guidance wall is a dynamo-electric machine according to claim 1 characterized by setting up greatly the wall surface of said method Kogo one end of rotation near the hand-of-cut front end of said support section, and setting it up small near the method Kogo edge of rotation of said support section at least.
[Claim 3] The tilt angle of said guidance wall is a dynamo-electric machine according to claim 1 characterized by applying near the method Kogo edge of rotation, and being gradually set up small near the hand-of-cut front end of said support section.
[Claim 4] Said guidance wall is a dynamo-electric machine according to claim 1 characterized by being arranged along with the cooling direction wind which flows into said cooling aperture in the rotational frequency from which the blowdown air temperature at the time of full load running serves as the highest.
[Claim 5] Said two or more cooling apertures are dynamo-electric machines according to claim 1 characterized by having extended from the peripheral wall of said housing to a shaft-orientations edge.
[Claim 6] Housing with which opening of two or more cooling apertures was carried out to the peripheral wall together with the single tier to the hoop direction, The stator fixed to said housing, and the rotator held free [rotation in said housing], It has the centrifugal fan which is located inside said cooling aperture and fixed to the edge of said rotator. The peripheral wall of said housing The guidance wall which specifies the cooling direction wind which blows off from said cooling aperture while being located between said two cooling apertures which adjoin a hoop direction and extending to shaft orientations, In a dynamo-electric machine equipped with the support section formed in a hoop direction rather than said guidance wall at double width while being located between said two cooling apertures which adjoin a hoop direction and extending to shaft orientations The hoop direction width of face of said cooling aperture is a dynamo-electric machine characterized by forming more broadly than the cooling aperture located in other fields the cooling aperture located in the staging area between said support sections.

[Claim 7] The hoop direction width of face of two or more of said cooling apertures is a dynamo-electric machine according to claim 6 characterized by being formed broadly in the location which was set as narrow near [said] the support section, and is distant from said support section.
[Claim 8] The hoop direction width of face of two or more of said cooling apertures is a dynamo-electric machine according to claim 6 characterized by being formed gradually broadly near said support section.
[Claim 9] The shaft-orientations die length of two or more of said cooling apertures is a dynamo-electric machine according to claim 1 or 6 characterized by forming the cooling aperture located in the staging area between said support sections for a long time than the cooling aperture located in other fields.
[Claim 10] The shaft-orientations die length of two or more of said cooling apertures is a dynamo-electric machine according to claim 1 or 6 characterized by being short formed near [said] the support section and being formed for a long time in the location distant from said support section.
[Claim 11] The shaft-orientations die length of two or more of said cooling apertures is a dynamo-electric machine according to claim 1 or 6 characterized by applying to the staging area between said support sections, and being gradually formed for a long time near said support section.
[Claim 12] The shaft-orientations die length of two or more of said cooling apertures is a dynamo-electric machine according to claim 1 or 6 characterized by being formed identically.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] Especially this invention relates to the cooling aperture structure which carries out opening to housing about the cooling structure of a dynamo-electric machine.
[0002]
[Description of the Prior Art] As JP,3-178539,A is shown in drawing 8 , it had the housing 100 with which opening of two or more cooling apertures w was carried out to the peripheral wall 101 together with the single tier to the hoop direction, and the centrifugal fan 106 which is located inside the cooling aperture w and fixed to the edge of a rotator (not shown), and the peripheral wall of housing 100 is equipped with the guidance wall 102 which is located between two cooling apertures w which adjoin a hoop direction, and extends to shaft orientations. The cooling wind which each guidance wall 102 has the fixed include angle theta, and is installed to the direction of a path, therefore blows off from the cooling aperture w blows off in this direction. Between two cooling apertures w which adjoin a hoop direction, the support section 103 has extended to shaft orientations, and the hoop direction width of face of the support section 103 is formed more widely than the width of face of the hoop direction of the guidance wall 102.
[0003]
[Problem(s) to be Solved by the Invention] However, in the above-mentioned dynamo-electric machine, the support section 103 constituted the big fluid resistance to a centrifugal fan, and had caused the increment in fluid loss, the fall of refrigeration capacity, or the increment in a whizzing sound. this invention is made in view of the above-mentioned trouble -- having -- the increment in need power -- nothing -- increase of cooling airflow -- possible -- low -- it sets it as the purpose to offer a noise dynamo-electric machine.
[0004]
[Means for Solving the Problem] Housing with which, as for the dynamo-electric machine of each invention, opening of two or more cooling apertures was carried out to the peripheral wall together with the single tier to the hoop direction, The stator fixed to said housing, and the rotator held free [rotation in said housing], It has the centrifugal fan which is located inside said cooling aperture and fixed to the edge of said rotator. The peripheral wall of said housing The guidance wall which specifies the cooling direction wind which blows off from said cooling aperture while being located between said two cooling apertures which adjoin a hoop direction and extending to shaft orientations, While being located between said two cooling apertures which adjoin a hoop direction and extending to shaft orientations, it has the support section formed in a hoop direction rather than said guidance wall at double width.
[0005] First, it is characterized by setting up greatly the tilt angle of said guidance wall [as opposed to the direction of a path in the dynamo-electric machine of claim 1] near the hand-of-cut front end of said support section, and being small set up near the method Kogo edge of rotation of said support section. Moreover, the dynamo-electric machine of claim 6 is characterized by forming more broadly than the cooling aperture to which the cooling aperture located in the staging area between said support sections

is located in other fields the hoop direction width of face of said cooling aperture.
[0006] Moreover, in an embodiment term, by claim 2, the wall surface of method Kogo one end of rotation of a guidance wall is large near the hand-of-cut front end of the support section, it is setting up small near the method Kogo edge of rotation, and structure is simplified and increase of cooling airflow can be aimed at. In claim 3, by the tilt angle of a guidance wall applying near the method Kogo edge of rotation, and being gradually set up small near the hand-of-cut front end of the support section, the flow and the tilt angle of a wind near [each] an aperture can approximate more, increase of cooling airflow can be aimed at, and silence can be improved.
[0007] In claim 4, by being set up along with the cooling direction wind which flows into a cooling aperture in the rotational frequency from which the blowdown air temperature at the time of full load running serves as the highest, the direction of a bowstring of a guidance wall (length of a wing direction) can make min fluid resistance of the guidance wall under the worst conditions, and can increase cooling airflow under the worst condition. That is, the worst thermal load in a dynamo-electric machine is generated in the predetermined rotational frequency field at the time of full load running. That is, generated output, internal heat dissipation resistance, and cooling airflow are changed at a rotational frequency, and the difference (internal temperature rise) of internal calorific value and heat release (you may regard it as cooling airflow generally) serves as max in a predetermined rotational frequency field.
[0008] At claim 5, two or more cooling apertures can blow off the air after cooling from the peripheral wall of housing more smoothly by having extended to a shaft-orientations edge. being formed broadly in the location which the hoop direction width of face of two or more cooling apertures was set as narrow near the support section, and is distant from the support section in claim 7 -- it is -- increase of cooling airflow -- possible -- low -- a noise dynamo-electric machine is realizable.
[0009] In claim 8, near the support section, the hoop direction width of face of two or more cooling apertures is formed broadly gradually, is made to the airflow in each cooling aperture location with the width of face which carried out abbreviation agreement, and can reduce fluid resistance more. In claim 9, suppressing increase of fluid resistance, by the cooling aperture located in the staging area between the support sections being formed for a long time than the cooling aperture located in other fields, the shaft-orientations die length of two or more cooling apertures can intercept effectively the noise generated inside housing, and can improve the reinforcement near the support section.
[0010] At claim 10, the shaft-orientations die length of two or more cooling apertures can acquire the same effectiveness as claim 9 by it being short formed near the support section and being formed for a long time in the location distant from the support section. In claim 11, the shaft-orientations die length of two or more cooling apertures is applying to the staging area between the support sections, and gradually formed for a long time near the support section, it is made with the die length according to the airflow in each cooling aperture location, suppresses increase of fluid resistance more, and can aim at further cutoff of the noise, and improvement in on the strength of near the support section.
[0011] In claim 12, the shaft-orientations die length of two or more cooling apertures is formed identically, and, in addition to increase of cooling airflow, can simplify structure.
[0012]
[Function and Effect(s) of the Invention] The cooling wind which came out of the centrifugal fan flows into the cooling aperture surrounding a centrifugal fan. Each cooling aperture is classified by the support section or the guidance wall in the hoop direction. A guidance wall specifies the cooling direction wind which blows off from a cooling aperture, and from a guidance wall, the support section is broadly formed in a hoop direction, and guarantees the reinforcement of housing.
[0013] In claim 1, the tilt angle of the guidance wall to the direction of a path is greatly set up near the hand-of-cut front end of the support section, and is small set up near the method Kogo edge of rotation of the support section. Therefore, a cooling wind inclines and blows off to a hoop direction a little near the hand-of-cut front end of the support section, and inclines and blows off in the direction of a path a little near the method Kogo edge of rotation of the support section.
[0014] Namely, the cooling wind (henceforth a wind) which came out of the centrifugal fan flows in the direction of slanting to the direction of a path, and a hoop direction. However, the wind which hit the

support section is bent by the support section to a hoop direction, consequently only the part which the wind bent in this support section to the hoop direction joined increases the component of velocity of the hoop direction of a wind [/ near the hand-of-cut front end of the support section]. Since whenever [tilt-angle / of the direction of a bowstring of a guidance wall] is determined to compensate for change of the above-mentioned wind by the above-mentioned support section according to this invention, the fluid resistance of a guidance wall is decreased, the rectification effectiveness also improves, and cooling airflow increases.

[0015] In claim 6, the cooling aperture to which the hoop direction width of face of a cooling aperture is located in the staging area of the support section is formed more broadly than the cooling aperture located in other fields, and, thereby, cooling airflow increases. That is, the fluid resistance to the wind with which it was interfered by the support section near the support section and which came out of the centrifugal fan is large, and in order that many cooling apertures may concentrate, the fluid resistance to the wind which came out of the centrifugal fan is small in the middle of the support section and the support section. That is, the airflow which blows off from a cooling aperture is small near the support section, and large in the location distant from the support section. Therefore, by making opening area of the cooling aperture of the location distant from the support section larger than the opening area of the cooling aperture near the support section, the fluid resistance as the whole is reduced, the wind velocity difference which came out of each cooling aperture also decreases, and cooling airflow increases.

[0016] Moreover, in each claim, a whizzing sound is also reduced, quiet operation also becomes possible and a high increase in power realizes it from the same physique.

[0017]

[Example] Drawing 1 - drawing 3 explain the AC generator for cars which is one example of this invention. First, the basic configuration of this generator is sketched. The frame (housing as used in the field of this invention) 1 which consists of a front frame 11 and a rear frame 12 is concluded with two or more conclusion bolts 13, a frame 1 is supported for a revolving shaft 2, enabling free rotation, the Landel mold field core 31 is fixed to a revolving shaft 2, and the field core 31 is looped around the field coil 32. A field core 31 and a field coil 32 constitute the rotator as used in the field of this invention. A field core 31 is surrounded to the inner skin of a frame 1, an armature core 33 is fixed, and the armature core 33 is looped around the armature coil 34. An armature core 33 and an armature coil 34 constitute the stator as used in the field of this invention.

[0018] The back end side of the rear frame 12 is ****(ed), covering 4 is being fixed, and the electrical-part room S is formed between the rear frame 12 and covering 4. The rectifier, brush, and regulator which are not illustrated are held in the electrical-part room S. If it excites by energizing to a field coil 32 while carrying out belt driving of the revolving shaft 2 through a pulley 21 with an engine, with a rectifier, three phase full wave rectification of the three-phase-alternating-current electrical potential difference generated with the armature coil 34 will be carried out, and it will be outputted. 10 is a bolt for rectifier installation.

[0019] Hereafter, it explains based on the sectional view showing the description part of this example in drawing 1 , and the front view showing the end face of the rear frame 12 after removing the covering 4 which shows drawing 2 . The mixed flow fan 5 and the centrifugal fan 6 are being fixed to the revolving shaft 2 across the field core 31. Together with the single tier, opening of much cooling aperture w' is carried out to the peripheral wall of the front frame 11 to the hoop direction, to the peripheral wall of the rear frame 12, each blades 60 of a centrifugal fan 6 are surrounded, and opening of many cooling apertures w is carried out together with the single tier to the hoop direction.

[0020] A part of wind which occurred by Hwang 5 blows off from cooling aperture w', and the remainder flows to a rear-side along with the periphery of a field core 31, and blows off from the cooling aperture w in the centrifugal direction. The physical relationship of each blades 60 of Hwang 6 serves as an irregular pitch, as shown in drawing 3 , a1 and other four sheets are set up with a2, and, as for spacing between each blades, other three sheets are set up for four sheets with a3 (a1<a2<a3). The wind which occurred from this Hwang 6 blows off from the cooling aperture w in the centrifugal direction.

[0021] The boundary region of the cooling aperture w is explained with reference to drawing 2 . The guidance wall 7 which specifies the cooling direction wind which blows off from a cooling aperture is arranged in the hoop direction boundary of each cooling aperture, respectively. Monobloc casting is carried out to the rear frame 12, the inner circumference edge (aerofoil point) and the periphery edge (aerofoil back end section) serve as a monotonous configuration which has ******, and the guidance wall 7 calls the dimension between an inner circumference edge (aerofoil tip) and a periphery edge (aerofoil back end) angular distance or the length of a wing.
[0022] Both the principal planes of the guidance wall 7 are parallel to shaft orientations, and are the abbreviation flat surfaces installed to the direction of a path, and the hoop direction. Therefore, between two adjoining guidance walls 7 and 7 each serves as the cooling aperture w, and the hoop direction width of face H of the cooling aperture w is measured by the right angle to average include-angle thetam= (thetaL+thetaF) / 2 of include-angle thetaL between the directions G of a bowstring of both the guidance wall 7 and the directions R of a path which touch the cooling aperture w concerned, and thetaF. In addition, let each bowstring direction G be the average of the tilt angle of both the principal planes of the corresponding guidance wall 7.
[0023] Moreover, it is located between two cooling apertures each which adjoin a hoop direction, and the support section 8 is formed. the support section 8 -- ****** -- five places are formed mostly at equal intervals, and the hoop direction width of face is formed by 2 to 5 times the sum of the hoop direction width of face of one the guidance wall 7 and one cooling aperture w. As shown in drawing 1 and drawing 2 , this support section 8 reaches directly under the conclusion bolt 13, and it is formed in the support location of stay 3, and the conclusion hole 14 of the rear frame 12 where the conclusion bolt 13 is screwed in is formed in the handle part 15 of the rear frame 12 which projects in the outer-diameter direction, and each handle part 15 is installed in the outer-diameter direction from the front end of each support section 8. Therefore, the support section 8 has the role which transmits the conclusion force of the conclusion bolt 13 to the rear frame 12 whole.
[0024] Next, the description of this example is explained. in this example, the include angle theta between the direction G of the bowstring of the guidance wall 7 and the direction R of a path (tilt angle as used in the field of this invention) is set up so greatly (it sleeps to a hoop direction -- as) that it is close to the hand-of-cut front end a of the support section 8, and is set up so small that it is close to the method Kogo edge b of rotation of the support section 8. For example, it is set up with theta1>theta2>theta3>theta4>theta5>theta6>theta7.
[0025] If it does in this way, a cooling wind will incline and blow off to a hoop direction a little near the hand-of-cut front end a of the support section 8, and will incline and blow off in the direction of a path a little near the method Kogo edge of rotation b of the support section 8. Namely, a cooling wind flows in the direction of slanting to the direction of a path, and a hoop direction. However, the wind which hit the support section 8 is bent by the support section 8 to the hoop direction front, consequently only the part which the wind bent in this support section 8 to the hoop direction joined increases the component of velocity of the hoop direction of a wind [/ near the hand-of-cut front end a of the support section 8]. After all, the wind which blows off from the cooling aperture w will go to sleep to a hoop direction, so that it approaches near the hand-of-cut front end a of the support section 8.
[0026] In addition, since the direction of a bowstring of each guidance wall 7 is changed little by little according to change of the direction wind by the above-mentioned support section 8, the fluid resistance of each guidance wall 7 decreases, the rectification effectiveness also improves, and cooling airflow increases. Moreover, in this example, the hoop direction width of face H of each cooling aperture w is narrowly set up in the about eight support section, and it is formed in double width as it separates from the support section 8. For example, it is set up with H2<H3<H4> H5> H6>H7.
[0027] If it does in this way, the fluid resistance to the wind with which it was interfered by the support section 8 in the about eight support section and which came out of the centrifugal fan 6 is large, and in order that many cooling apertures w may concentrate, in the staging area between the support section 8 and the support section 8, the fluid resistance to the wind which came out of the centrifugal fan 6 is small. That is, the airflow which blows off from the cooling aperture w is small in the about eight

support section, and large in the location distant from the support section 8. Therefore, by making opening area of the cooling aperture w of the location distant from the support section 8 larger than the opening area of the about eight support section cooling aperture w, the fluid resistance as the whole is reduced, the wind velocity difference which came out of each cooling aperture w also decreases, and cooling airflow increases.
(Example 2) The following example is explained with reference to drawing 1 - drawing 3 .
[0028] In this example, the direction G of a bowstring of the guidance wall 7 (length of a wing direction) is set up along with cooling direction wind K which flows into the cooling aperture w in the rotational frequency from which the blowdown air temperature at the time of full load running (at the time of design maximum allowed current electric supply) serves as the highest. In addition, although the rotational frequency ntmax from which the blowdown air temperature at the time of full load running (at the time of design maximum allowed current electric supply) serves as the highest varies somewhat by each model, in an AC dynamo, it is 3000 - 4000rpm generally in many cases. Fluid loss is small if the difference of whenever [tilt-angle / of the guidance wall 7], and whenever [fluid inlet angle / of the inflow style] is 10 or less degrees, And the cooling direction wind which flows at the cooling aperture w in the case of the rotational frequency of 0.8 - 1.2xntmax since change of a wind is small, if change of a rotational frequency is within the limits of 0.8 - 1.2xntmax, in agreement in the direction G of a bowstring of the guidance wall 7 (length of a wing direction) -- making (both difference meaning 10 or less degrees) -- the fluid resistance of the guidance wall 7 in this service condition serves as min, and can increase cooling airflow.
[0029] Moreover, if the support section 8 is formed also in this example 2, it will be necessary to change the tilt angle of each guidance wall 7 etc. like an example 1, respectively. In addition, in each above-mentioned example, a whizzing sound is also reduced and quiet operation also becomes possible.
(Experiment 1) An experimental result is shown in drawing 4 .
[0030] This experiment surveys the wind direction (the direction and drawing 4 which show the maximum wind speed show as a peak include angle) and airflow in each hoop direction angular position phi from the support section 8 in the model from which the two support sections 8 located in the upper part in drawing 2 and the guidance wall 7 which classifies each cooling aperture w between eight into a hoop direction were removed altogether. The rotational frequency was set to 3500rpm. An experimental model is the AC generator for cars of rated voltage 12V and rated output 100A. 0 degree and about 90 degrees are the locations of the support section 8.
[0031] From drawing 4 , an example 1, the importance of the configuration of two, and its effectiveness will be understood.
(Experiment 2) The relation between the rotational frequency of each experimental model and airflow is shown in drawing 5 . A continuous line is the case where the above-mentioned examples 1 and 2 are carried out, an alternate long and short dash line is the case of a guidance wall (rib) include-angle gradual change and width-of-window regularity, a two-dot chain line is the case of rib include-angle regularity and a width-of-window gradual change, and a broken line is the case where only the above-mentioned example 2 is carried out (however, the tilt angle of each guidance wall 7 is the same).
(Example 3) The following example is explained with reference to drawing 6 and drawing 7 .
[0032] In this example, it is specified as include-angle thetaLB of the wall surface of method Kogo one end of rotation, and like [this include angle] the example 1, the tilt angle theta of the guidance wall 7 is missing from the method Kogo edge b of rotation from from near the hand-of-cut front end a of the support section 8, and is set up small gradually. The width of face of the cooling aperture W is the same as that of an example 1. Moreover, drawing 7 is the direction view Fig. of A of drawing 6 , and it is gradually formed for a long time near the support section 8, shaft-orientations applying [of the cooling aperture W] it to the staging area between the support sections.
[0033] By this configuration, like an example 1, the fluid resistance of each guidance wall 7 decreases, the rectification effectiveness also improves, and cooling airflow increases. The noise especially generated from root Motobe 34b of the armature coil 34 inside a frame can be intercepted good. Furthermore, if a cooling window surface product is recklessly enlarged in order to raise cooling nature

as much as possible when casting in the case of manufacture, for example, a die-casting frame Since the width of face of a guidance wall becomes thin, it is easy to deform and, especially as for the guidance wall of the next door of the support section 8, width of face and the depth with the support section change a lot suddenly, Although it becomes the cause of the poor circumference of a molten bath of die casting and is easy to become the lack of on the strength, these problems do not exist, and it is stabilized very much, and can cast now in this example, and reinforcement can also improve sharply.
[0034] In addition, in an example 3, it is good also as fixed, and the shaft-orientations die length of the cooling aperture W may be gradually formed for a long time in examples 1 and 2, applying the shaft-orientations die length of the cooling aperture W to the staging area between the support sections near the support section, and it is good also as fixed.

[Translation done.]

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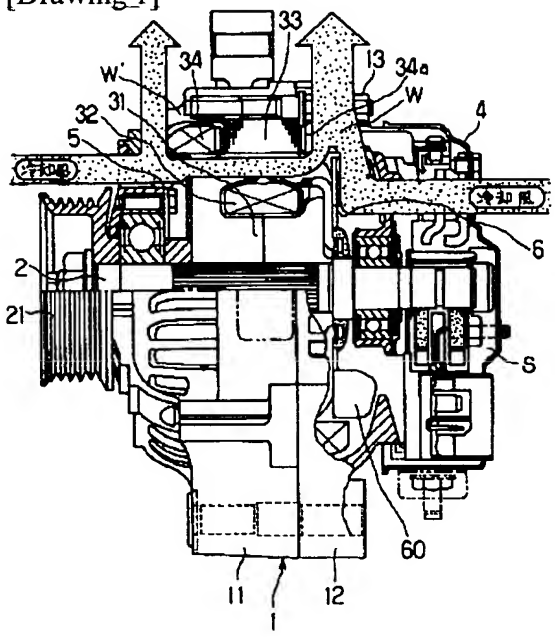
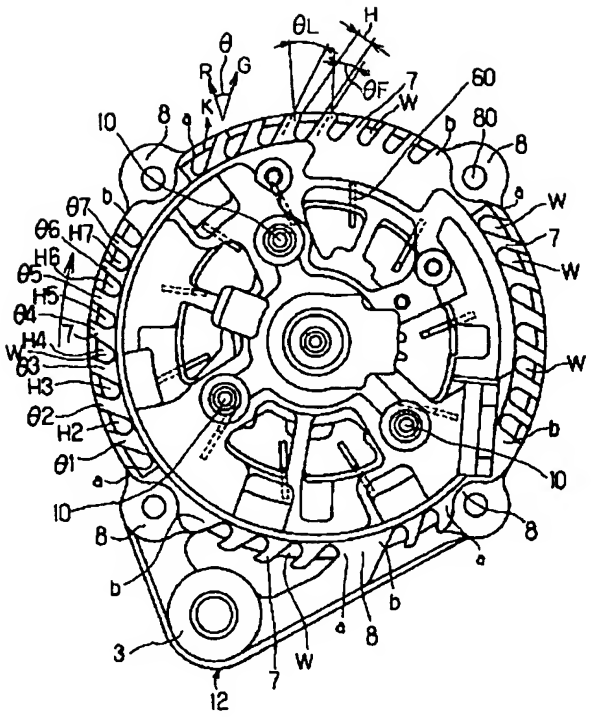
DRAWINGS

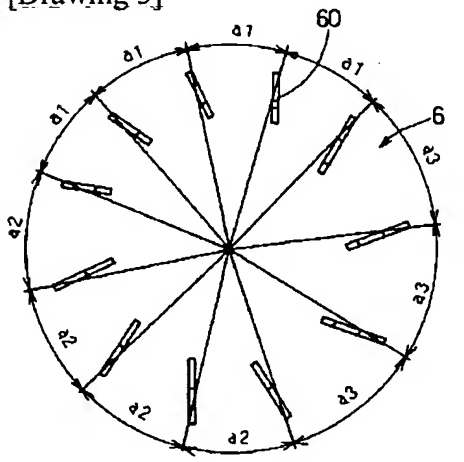
[Drawing 1]



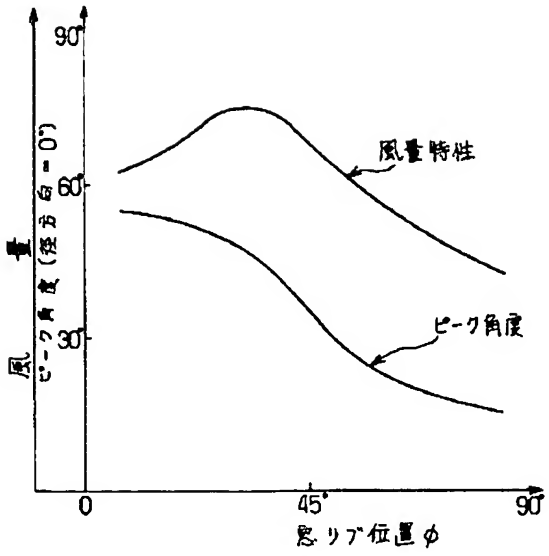
[Drawing 2]



[Drawing 3]



[Drawing 4]



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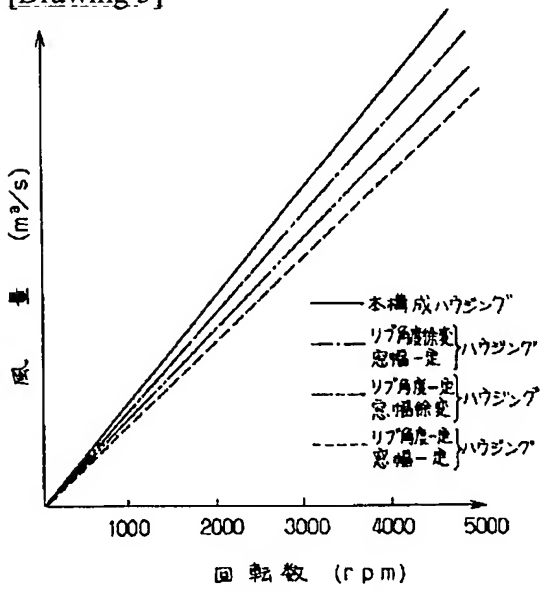
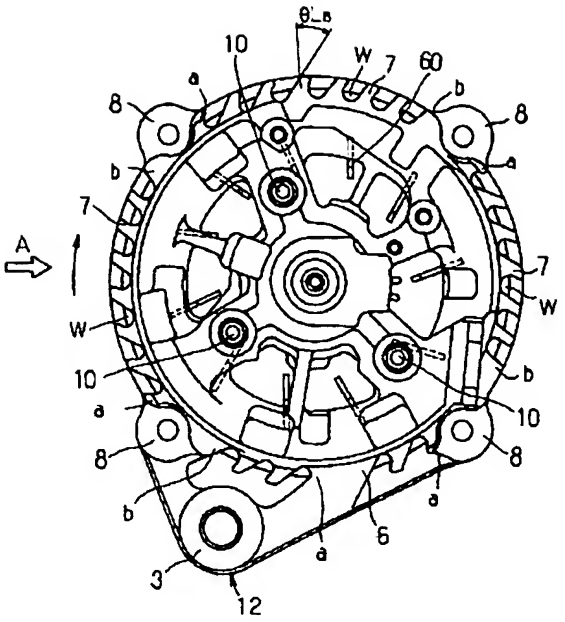
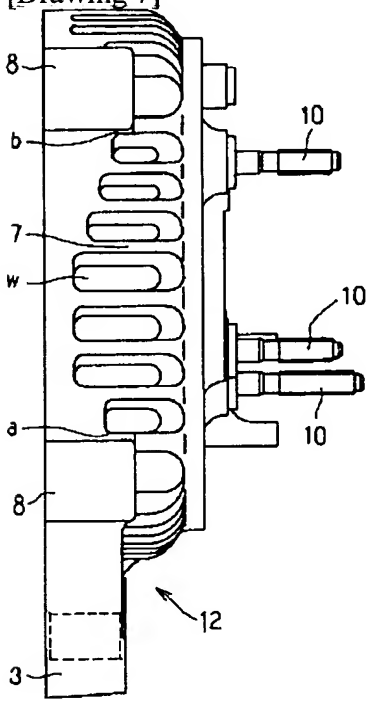


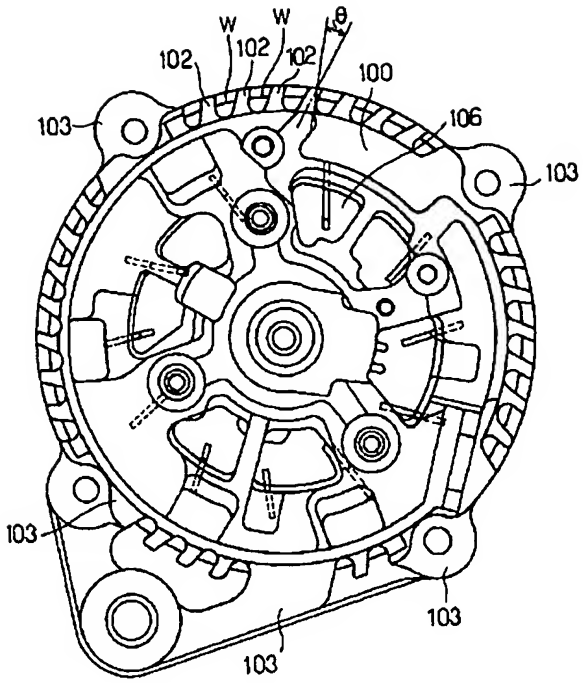
[Drawing 6]



[Drawing 7]



[Drawing 8]



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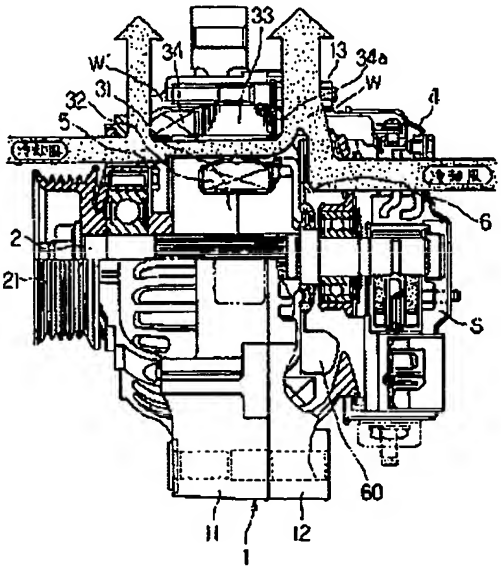
(54)【発明の名称】　回転電機

(57)【要約】

【目的】　必要動力の増加なしに冷却風量の増大が可能な回転電機を提供する。

【構成】　遠心ファンから出た冷却風は遠心ファンを囲む多数の冷却窓ｗに流入する。各冷却窓ｗは周方向においてサポート部８又は案内壁部７により区分される。径方向に対する案内壁部７の傾斜角は、サポート部８の回転方向前端ａ近傍にて大きく設定され、サポート部８の回転方向後端ｂ近傍にて小さく設定され、これにより冷却風量が増加する。また、冷却窓ｗの周方向幅Ｈが、サポート部８近傍にて狭小に設定されサポート部８から離れた位置にて幅広に形成され、これにより冷却風量が増加する。さらに、全負荷運転時の吹き出し空気温度が最高となる回転数において冷却窓ｗに流入する冷却風の方向に沿って案内壁部７が配設される。また、冷却窓ｗの軸方向長さが、サポート部８近傍よりサポート部間中間領域にかけて徐々に長く形成する。



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【特許請求の範囲】

【請求項１】　複数の冷却窓が周方向へ一列に並んで周壁に開口されたハウジングと、前記ハウジング内に固定される固定子と、前記ハウジング内に回転自在に保持される回転子と、前記冷却窓の内側に位置して前記回転子の端部に固定される遠心ファンとを備え、前記ハウジングの周壁は、周方向に隣接する２個の前記冷却窓の間に位置して軸方向へ延在するとともに前記冷却窓から吹き出される冷却風の方向を規定する案内壁部と、周方向に隣接する２個の前記冷却窓の間に位置して軸方向へ延在するとともに前記案内壁部よりも周方向へ広幅に形成されるサポート部とを備える回転電機において、

径方向に対する前記案内壁部の傾斜角は、前記サポート部の回転方向前端近傍にて大きく設定され、前記サポート部の回転方向後端近傍にて小さく設定されることを特徴とする回転電機。

【請求項２】　前記案内壁部の傾斜角は、少なくとも前記回転方向後端側の壁面が、前記サポート部の回転方向前端近傍にて大きく設定され、前記サポート部の回転方向後端近傍にて小さく設定されることを特徴とする請求項１記載の回転電機。

【請求項３】　前記案内壁部の傾斜角は、前記サポート部の回転方向前端近傍から回転方向後端近傍にかけて徐々に小さく設定されることを特徴とする請求項１記載の回転電機。

【請求項４】　前記案内壁部は、全負荷運転時の吹き出し空気温度が最高となる回転数において前記冷却窓に流入する冷却風の方向に沿って配設されることを特徴とする請求項１記載の回転電機。

【請求項５】　前記複数の冷却窓は、前記ハウジングの周壁より軸方向端部まで延在されていることを特徴とする請求項１記載の回転電機。

【請求項６】　複数の冷却窓が周方向へ一列に並んで周壁に開口されたハウジングと、前記ハウジングに固定される固定子と、前記ハウジングに回転自在に保持される回転子と、前記冷却窓の内側に位置して前記回転子の端部に固定される遠心ファンとを備え、前記ハウジングの周壁は、周方向に隣接する２個の前記冷却窓の間に位置して軸方向へ延在するとともに前記冷却窓から吹き出される冷却風の方向を規定する案内壁部と、周方向に隣接する２個の前記冷却窓の間に位置して軸方向へ延在するとともに前記案内壁部よりも周方向へ広幅に形成されるサポート部とを備える回転電機において、

前記冷却窓の周方向幅は、前記サポート部間の中間領域に位置する冷却窓が他の領域に位置する冷却窓より幅広に形成されることを特徴とする回転電機。

【請求項７】　前記複数の冷却窓の周方向幅は、前記サポート部近傍にて幅狭に設定され、前記サポート部から離れた位置にて幅広に形成されることを特徴とする請求項６記載の回転電機。

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【請求項８】　前記複数の冷却窓の周方向幅は、前記サポート部の近傍より徐々に幅広に形成されることを特徴とする請求項６記載の回転電機。

【請求項９】　前記複数の冷却窓の軸方向長さは、前記サポート部間の中間領域に位置する冷却窓が他の領域に位置する冷却窓より長く形成されることを特徴とする請求項１または６記載の回転電機。

【請求項１０】　前記複数の冷却窓の軸方向長さは、前記サポート部近傍にて短く形成され、前記サポート部から離れた位置にて長く形成されることを特徴とする請求項１または６記載の回転電機。

【請求項１１】　前記複数の冷却窓の軸方向長さは、前記サポート部の近傍より前記サポート部間の中間領域にかけて徐々に長く形成されることを特徴とする請求項１または６記載の回転電機。

【請求項１２】　前記複数の冷却窓の軸方向長さは、同一に形成されていることを特徴とする請求項１または６に記載の回転電機。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、回転電機の冷却構造に関し、特にハウジングに開口する冷却窓構造に関する。

【０００２】

【従来の技術】特開平３－１７８５３９号公報は、図８に示すように、複数の冷却窓ｗが周方向へ一列に並んで周壁１０１に開口されたハウジング１００と、冷却窓ｗの内側に位置して回転子（図示せず）の端部に固定される遠心ファン１０６とを備え、ハウジング１００の周壁は、周方向に隣接する２個の冷却窓ｗの間に位置して軸方向へ延在する案内壁部１０２を備えている。各案内壁部１０２は径方向に対して一定角度Θを有して斜設されており、したがって、冷却窓ｗから吹き出される冷却風はこの方向に吹き出される。周方向に隣接する２個の冷却窓ｗの間には、サポート部１０３が軸方向へ延在しており、サポート部１０３の周方向幅は案内壁部１０２の周方向の幅よりも広く形成されている。

【０００３】

【発明が解決しようとする課題】しかしながら上記した回転電機において、サポート部１０３が遠心ファンに対する大きな流体抵抗を構成し、流体損失の増加、冷却能力の低下、あるいは風切り音の増加を招いていた。本発明は上記問題点に鑑みなされたものであり、必要動力の増加なしに冷却風量の増大が可能で、低騒音な回転電機を提供することをその目的としている。

【０００４】

【課題を解決するための手段】各発明の回転電機は、複数の冷却窓が周方向へ一列に並んで周壁に開口されたハウジングと、前記ハウジングに固定される固定子と、前記ハウジングに回転自在に保持される回転子と、前記冷却窓の内側に位置して前記回転子の端部に固定される遠

心ファンとを備え、前記ハウジングの周壁は、周方向に隣接する2個の前記冷却窓の間に位置して軸方向へ延在するとともに前記冷却窓から吹き出される冷却風の方向を規定する案内壁部と、周方向に隣接する2個の前記冷却窓の間に位置して軸方向へ延在するとともに前記案内壁部よりも周方向へ広幅に形成されるサポート部とを備えている。

【0005】まず、請求項1の回転電機は、径方向に対する前記案内壁部の傾斜角は、前記サポート部の回転方向前端近傍にて大きく設定され、前記サポート部の回転方向後端近傍にて小さく設定されることを特徴としている。また、請求項6の回転電機は、前記冷却窓の周方向幅は、前記サポート部間の中間領域に位置する冷却窓が他の領域に位置する冷却窓より幅広に形成されることを特徴としている。

【0006】また、実施態様項においては、請求項2では、案内壁部の回転方向後端側の壁面が、サポート部の回転方向前端近傍にて大きく、回転方向後端近傍にて小さく設定することで、構造を簡単化し冷却風量の増大が図れる。請求項3では、案内壁部の傾斜角がサポート部の回転方向前端近傍から回転方向後端近傍にかけて徐々に小さく設定されることで、各窓付近の風の流れと傾斜角とがより近似し冷却風量の増大が図れ、静粛性を向上することができる。

【0007】請求項4では、案内壁部の弦方向（翼長方向）が全負荷運転時の吹き出し空気温度が最高となる回転数において冷却窓に流入する冷却風の方向に沿って設定されることで、最悪条件下における案内壁部の流体抵抗を最小とし、最悪条件下において冷却風量を増大することができる。すなわち、回転電機における最悪の熱負荷は全負荷運転時における所定の回転数領域において発生する。つまり、発電電力、内部放熱抵抗及び冷却風量は回転数により変動し、内部発熱量と放熱量（大体冷却風量とみなしてもよい）との差（内部温度上昇）は所定の回転数領域において最大となる。

【0008】請求項5では、複数の冷却窓は、ハウジングの周壁より軸方向端部まで延在されていることで、冷却後の空気をより円滑に吹き出すことができる。請求項7では、複数の冷却窓の周方向幅は、サポート部近傍にて幅狭に設定され、サポート部から離れた位置にて幅広に形成されることで、冷却風量の増大が可能で、低騒音な回転電機を実現できる。

【0009】請求項8では、複数の冷却窓の周方向幅は、サポート部の近傍より徐々に幅広に形成されることで、各冷却窓位置における風量に略合致した幅とでき、より流体抵抗を低減できる。請求項9では、複数の冷却窓の軸方向長さが、サポート部間の中間領域に位置する冷却窓が他の領域に位置する冷却窓より長く形成されることで、流体抵抗の増大を抑えながら、ハウジング内部で発生する騒音を有効に遮断でき、サポート部付近の強度を向上できる。

【0010】請求項10では、複数の冷却窓の軸方向長さは、サポート部近傍にて短く形成され、サポート部から離れた位置にて長く形成されることで、請求項9と同様の効果を得ることができる。請求項11では、複数の冷却窓の軸方向長さは、サポート部の近傍よりサポート部間の中間領域にかけて徐々に長く形成されることで、各冷却窓位置における風量に応じた長さとでき、より流体抵抗の増大を抑え、騒音の遮断、サポート部付近の強度向上を一層図れる。

【0011】請求項12では、複数の冷却窓の軸方向長さは、同一に形成されていることで、冷却風量の増大に加え、構造を簡単化できる。

【0012】

【作用及び発明の効果】遠心ファンから出た冷却風は遠心ファンを囲む冷却窓に流入する。各冷却窓は周方向においてサポート部又は案内壁部により区分されている。案内壁部は冷却窓から吹き出される冷却風の方向を規定し、サポート部は案内壁部より周方向へ幅広に形成されてハウジングの強度を保証する。

【0013】請求項1では、径方向に対する案内壁部の傾斜角は、サポート部の回転方向前端近傍にて大きく設定され、サポート部の回転方向後端近傍にて小さく設定される。したがって、冷却風は、サポート部の回転方向前端近傍にてやや周方向へ傾いて吹き出され、サポート部の回転方向後端近傍にてやや径方向へ傾いて吹き出される。

【0014】すなわち、遠心ファンから出た冷却風（以下、風という）は径方向及び周方向に対し斜めの方向へ流れる。ただし、サポート部に当たった風はサポート部により周方向へ曲げられ、その結果、サポート部の回転方向前端近傍における風の周方向の分速度はこのサポート部に当たって周方向へ曲げられた風の加入した分だけが増加する。この発明によれば、上記したサポート部による上記風向きの変化に合わせて案内壁部の弦方向の傾斜角度を決定しているので、案内壁部の流体抵抗を減少し、整流効果も向上し、冷却風量が増大する。

【0015】請求項6では、冷却窓の周方向幅が、サポート部の中間領域に位置する冷却窓が他の領域に位置する冷却窓より幅広に形成され、これにより冷却風量が増加する。すなわち、サポート部近傍ではサポート部に邪魔されて遠心ファンから出た風に対する流体抵抗は大きく、サポート部とサポート部との中間では、多数の冷却窓が集中するために遠心ファンから出た風に対する流体抵抗は小さい。つまり、冷却窓から吹き出す風量は、サポート部近傍にて小さく、サポート部から離れた位置にて大きい。したがって、サポート部から離れた位置の冷却窓の開口面積をサポート部近傍の冷却窓の開口面積より大きくすることにより、全体としての流体抵抗を低減し、各冷却窓から出た風の速度差も減少し、冷却風量が

増大する。

【００１６】また、各請求項において、風切り音も低減されて静粛運転も可能となり、同一体格で高出力化が実現する。

【００１７】

【実施例】本発明の一実施例である車両用交流発電機を図１～図３で説明する。まず、この発電機の基本構成を略述する。フロントフレーム１１とリヤフレーム１２からなるフレーム（本発明でいうハウジング）１は複数の締結ボルト１３で締結されており、フレーム１は回転軸２を回転自在に支承し、回転軸２にはランデル型界磁鉄心３１が固定され、界磁鉄心３１には界磁コイル３２が巻装されている。界磁鉄心３１及び界磁コイル３２は本発明でいう回転子を構成する。フレーム１の内周面には界磁鉄心３１を囲んで電機子鉄心３３が固定され、電機子鉄心３３には電機子コイル３４が巻装されている。電機子鉄心３３及び電機子コイル３４は本発明でいう固定子を構成する。

【００１８】リヤフレーム１２の後端面を囲程してカバー４が固定されており、リヤフレーム１２とカバー４との間に電気部品室Ｓが形成されている。電気部品室Ｓには図示しない整流装置やブラシやレギュレータが収容されている。エンジンによりプーリー２１を通じて回転軸２をベルト駆動するとともに、界磁コイル３２に通電して励磁を行うと、電機子コイル３４で発生した三相交流電圧が整流装置で三相全波整流されて出力される。１０は整流装置取り付け用のボルトである。

【００１９】以下、本実施例の特徴部分を、図１に示す断面図、図２に示すカバー４を外した後のリヤフレーム１２の端面を表す正面図に基づいて説明する。回転軸２には界磁鉄心３１を挟んで斜流ファン５及び遠心ファン６が固定されている。フロントフレーム１１の周壁には多数の冷却窓ｗ'が周方向へ一列に並んで開口されており、リヤフレーム１２の周壁には遠心ファン６の各ブレード６０を囲んで多数の冷却窓ｗが周方向へ一列に並んで開口されている。

【００２０】ファン５により生起された風の一部は冷却窓ｗ'から吹き出され、残りは界磁鉄心３１の外周に沿ってリヤ側へ流れ冷却窓ｗから遠心方向へ吹き出される。ファン６の各ブレード６０の位置関係は図３に示すように不等ピッチとなっており、各ブレード間の間隔は４枚がａ１、他の４枚がａ２、他の３枚がａ３と設定されている（ａ１＜ａ２＜ａ３）。このファン６より生起された風は冷却窓ｗから遠心方向へ吹き出される。

【００２１】冷却窓ｗの周辺領域について図２を参照して説明する。各冷却窓の周方向境界には、冷却窓から吹き出される冷却風の方向を規定する案内壁部７がそれぞれ配設されている。案内壁部７は、リヤフレーム１２と一体鋳造されており、内周端部（風先端部）と外周端部（風後端部）がまるみを有する平板形状となっており、内周端（風先端）から外周端（風後端）との間の寸法を弦長又は風長と呼ぶ。

【００２２】案内壁部７の両主面は軸方向に平行で、かつ、径方向及び周方向に対し斜設された略平面となっている。したがって、隣接する各２個の案内壁部７、７の間が冷却窓ｗとなっており、冷却窓ｗの周方向幅Ｈは、当該冷却窓ｗに接する両案内壁部７の弦方向Ｇと径方向Ｒとの間の角度ΘＬ、ΘＦの平均角度Θｍ＝（ΘＬ＋ΘＦ）／２に対し直角に計測される。なお、各弦方向Ｇは対応する案内壁部７の両主面の傾斜角の平均値とする。

【００２３】また、周方向に隣接する各２個の冷却窓の間に位置してサポート部８が形成されている。サポート部８は周方向ほぼ等間隔に５箇所形成され、その周方向幅は、１個の案内壁部７と１個の冷却窓ｗとの周方向幅の和の２～５倍に形成されている。図１及び図２に示すように、このサポート部８は締結ボルト１３の直下に及びステー３の支持位置に形成されるものであって、締結ボルト１３が螺入されるリヤフレーム１２の締結穴１４は外径方向に突出するリヤフレーム１２の耳部１５に形成され、各耳部１５は各サポート部８の前端から外径方向へ延設されている。したがってサポート部８は、締結ボルト１３の締結力をリヤフレーム１２全体に伝達する役割を有している。

【００２４】次に、この実施例の特徴を説明する。この実施例において、案内壁部７の弦の方向Ｇと径方向Ｒとの間の角度（本発明でいう傾斜角）Θは、サポート部８の回転方向前端ａに近いほど大きく（周方向へ寝るように）設定され、サポート部８の回転方向後端ｂに近いほど小さく設定されている。例えば、Θ１＞Θ２＞Θ３＞Θ４＞Θ５＞Θ６＞Θ７と設定されている。

【００２５】このようにすれば、冷却風は、サポート部８の回転方向前端ａ近傍にてやや周方向へ傾いて吹き出され、サポート部８の回転方向後端ｂ近傍にてやや径方向へ傾いて吹き出される。すなわち、冷却風は径方向及び周方向に対し斜めの方向へ流れる。ただし、サポート部８に当たった風はサポート部８により周方向前方へ曲げられ、その結果、サポート部８の回転方向前端ａ近傍における風の周方向の分速度はこのサポート部８に当たって周方向へ曲げられた風の加入した分だけ増加する。結局、サポート部８の回転方向前端ａ近傍に接近するほど、冷却窓ｗから吹き出す風は周方向へ寝ることになる。

【００２６】なお、上記したサポート部８による風の方向の変化に合わせて、各案内壁部７の弦方向を少しづつ変化させているので、各案内壁部７の流体抵抗が減少し、整流効果も向上し、冷却風量が増大する。また、この実施例では、各冷却窓ｗの周方向幅Ｈは、サポート部８近傍にて狭小に設定され、サポート部８から離れるにつれて広幅に形成されている。例えば、Ｈ２＜Ｈ３＜Ｈ４＞Ｈ５＞Ｈ６＞Ｈ７と設定されている。

【００２７】このようにすれば、サポート部８近傍ではサポート部８に邪魔されて遠心ファン６から出た風に対する流体抵抗は大きく、サポート部８とサポート部８との間の中間領域では、多数の冷却窓ｗが集中するために遠心ファン６から出た風に対する流体抵抗は小さい。つまり、冷却窓ｗから吹き出す風量は、サポート部８近傍にて小さく、サポート部８から離れた位置にて大きい。したがって、サポート部８から離れた位置の冷却窓ｗの開口面積をサポート部８近傍の冷却窓ｗの開口面積より大きくすることにより、全体としての流体抵抗を低減し、各冷却窓ｗから出た風の速度差も減少し、冷却風量が増大する。

（実施例２）次の実施例を図１～図３を参照して説明する。

【００２８】この実施例では、全負荷運転（設計最大許容電流給電時）時の吹き出し空気温度が最高となる回転数において、冷却窓ｗに流入する冷却風の方向Ｋに沿って案内壁部７の弦方向（翼長方向）Ｇが設定される。なお、全負荷運転（設計最大許容電流給電時）時の吹き出し空気温度が最高となる回転数ｎｔｍａｘは、各機種によって多少ばらつくが、オルタネータでは大体３０００～４０００ｒｐｍである場合が多い。案内壁部７の傾斜角度と流入風の流入角度との差が１０度以下であれば流体損失は小さいこと、及び、回転数の変化が０．８～１．２×ｎｔｍａｘの範囲内であれば風向きの変化は小さいことから、０．８～１．２×ｎｔｍａｘの回転数の場合に冷却窓ｗに流入する冷却風の方向と、案内壁部７の弦方向（翼長方向）Ｇとを一致させる（両者の差が１０度以下を意味する）と、この運転条件における案内壁部７の流体抵抗は最小となり、冷却風量を増大することができる。

【００２９】また、この実施例２でもサポート部８が設けられていれば実施例１と同様に各案内壁部７の傾斜角等をそれぞれ変化させる必要が生じる。なお、上記各実施例において、風切り音も低減され、静粛運転も可能となる。

（実験１）図４に実験結果を示す。

【００３０】この実験は、図２において上部に位置する２個のサポート部８、８間の各冷却窓ｗを周方向に区分する案内壁部７を全て除去したモデルにおいて、サポート部８からの各周方向角度位置Φにおける風向（最大風速を示す方向、図４ではピーク角度として示す）と風量とを実測したものである。回転数は３５００ｒｐｍとした。実験モデルは、定格電圧１２Ｖ、定格出力１００Ａの車両用交流発電機である。０°、９０°近傍はサポート部８の位置である。

【００３１】図４から、実施例１、２の構成の重要性及びその効果が理解されるであろう。

（実験２）図５に各実験モデルの回転数と風量との関係を示す。実線は上記実施例１、２を実施した場合であり、一点鎖線は案内壁部（リブ）角度徐変、窓幅一定の場合であり、二点鎖線はリブ角度一定、窓幅徐変の場合であり、破線は上記実施例２のみ（ただし、各案内壁部７の傾斜角は同じ）を実施した場合である。

（実施例３）次の実施例を図６及び図７を参照して説明する。

【００３２】この実施例では、案内壁部７の傾斜角Θが、回転方向後端側の壁面の角度ΘＬＢとして規定され、この角度が実施例１と同様にサポート部８の回転方向前端ａ近傍から回転方向後端ｂにかけて徐々に小さく設定されている。冷却窓Ｗの幅は実施例１と同様である。また、図７は図６のＡ方向矢視図であり、冷却窓Ｗの軸方向長さはサポート部８の近傍よりサポート部間の中間領域にかけて徐々に長く形成されている。

【００３３】この構成により、実施例１と同様に、各案内壁部７の流体抵抗が減少し、整流効果も向上し、冷却風量が増大する。特に、フレーム内部の磁極子コイル３４の根元部３４ｂから発生するノイズを良好に遮断できる。さらに、製造の際、例えばダイカストフレームで鋳造する場合、冷却性をできる限り上げるべくむやみに冷却窓面積を大きくすると、案内壁部の幅が細くなり変形し易く、特に、サポート部８の隣の案内壁部はサポート部との幅および深さが急に大きく変化するため、ダイカストの湯まわり不良の原因となり、強度不足になり易いが、本実施例ではこれらの問題がなく非常に安定して鋳造できるようになり、強度も大幅に向上する事ができる。

【００３４】なお、実施例３において、冷却窓Ｗの軸方向長さを一定としてもよく、また、実施例１及び２において、冷却窓Ｗの軸方向長さはサポート部の近傍よりサポート部間の中間領域にかけて徐々に長く形成してもよく、一定としてもよい。

【図面の簡単な説明】

【図１】本発明の一実施例の車両用交流発電機の断面図である。

【図２】カバー及び電気部品をはずした図１の発電機のリヤ側からみた正面図である。

【図３】リヤ側ファンのブレードの配置関係を示す図である。

【図４】図１の発電機の冷却窓における吹き出し風量及び風向と周方向角度位置との関係を示す特性図である。

【図５】各実施例モデルの回転数と吹き出し風量との関係を示す特性図である。

【図６】本発明の他の実施例を示し、カバー及び電気部品をはずした図１の発電機のリヤ側からみた正面図である。

【図７】図６のＡ方向から見た側面図である。

【図８】カバー及び電気部品をはずした従来の発電機のリヤ側からみた正面図である。

【符号の説明】

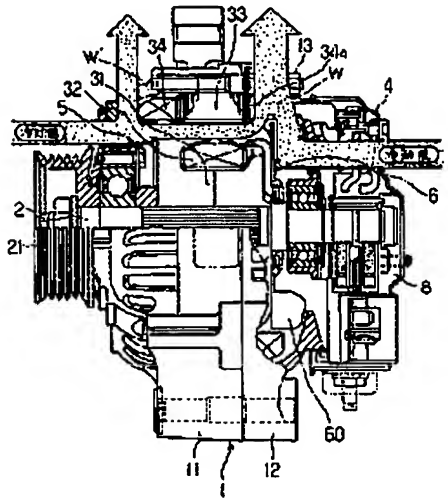
9

6　遠心ファン
7　案内壁部
8　サポート部
11　フロントフレーム（ハウジング）

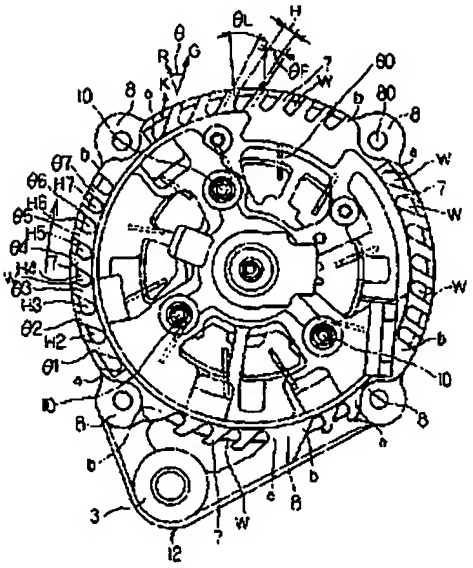
10

＊12　リヤフレーム（ハウジング）
31　界磁鉄心（回転子）
33　電機子鉄心（固定子）
＊　w　冷却窓。

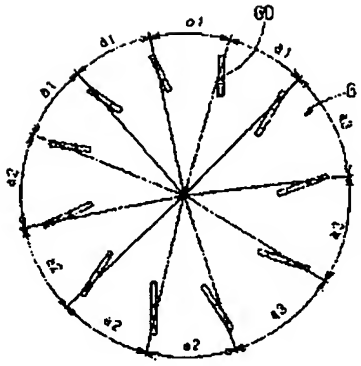
【図1】



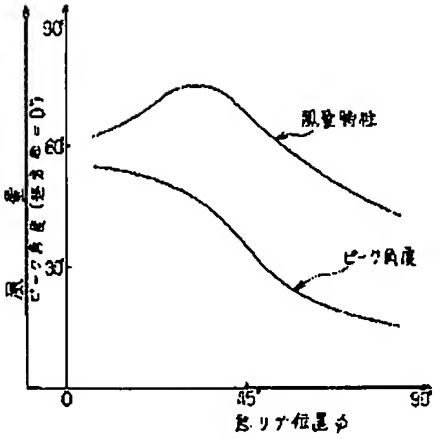
【図2】



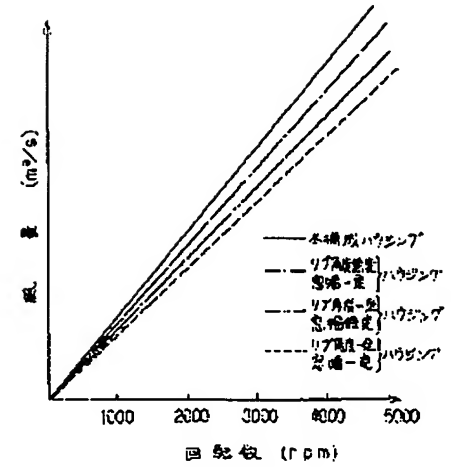
【図3】



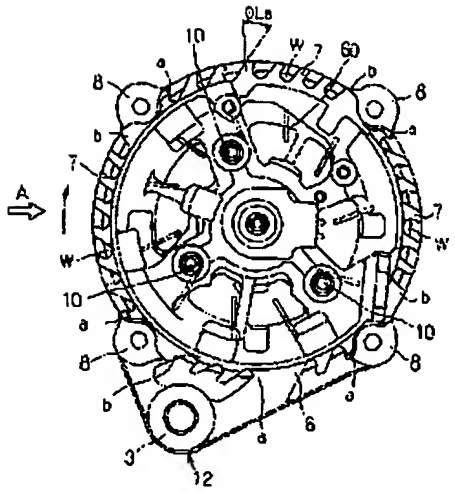
【図4】



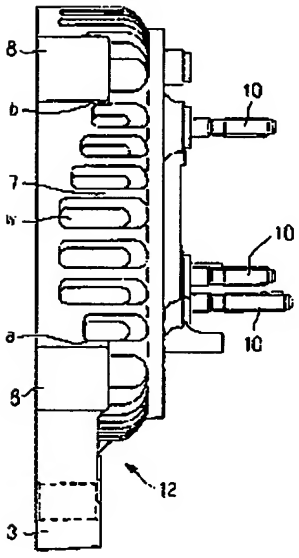
【図5】



【図6】



【図7】



【図8】